Sharpening a Knife—Information & Tips from a Veterinarian Whose Wife & Meat Cutting Put Him Through College

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Abstract

This article presents key points to sharpening a knife. It provides information on metal differences, sharpening abrasives, blade shapes, cutting edge angles, determining when a cutting edge is sharp, finishing and testing the cutting edge, proper use of a steel to maintain the cutting edge, and knife safety. Other topics included are manual and motorized sharpening systems, and how to build a knife sharpener. Diagrams illustrating the key points and sources for supplies are provided in each segment.

I hope you enjoy reading this material as much as I have enjoyed researching and writing it. A special thanks to everyone who contributed ideas, information, and tips ... send me yours (dgriffin@gpvec.unl.edu). If you are as busy as most veterinarians who need sharp tools for doing a necropsy, you might find everything you need to know in the summary on the last page.

A sharp knife is a wonderful tool and a point of pride. However, sharpening a knife can be a tough skill for many to learn. In this article I will share with you keys to having a sharp knife.

Key Point: Selecting a Sharpening System

Sharpening Abrasives: While aluminum oxide is the most common sharpening abrasive available. Course (~100 grit), Medium (~300 grit), Fine (~600 grit), and Ex-Fine (~1200 grit), most knives can be sharpened nicely with any abrasive finer than 300 grit (medium or fine). Some grits and texture (coarseness) labels listed on stones/hones will seem to contradict each other. I have seen stones labeled 180-fine that seemed to me to be very smooth, much smoother than I would expect from a 180 grit. If in doubt, buy the hone with the texture label (not the grit) that matches your needs.

Arkansas (hard - black) and ceramic hones usually fall in the Fine and Ex-fine categories. Diamond embedded abrasives are excellent (expensive and worth every penny) and come in all grits (Available from EZE-LAP, 800-843-4815 or Diamond Machining Technology (DMT) from Marlborough, MA).

The best manual abrasives are flat, wide (>2") and long (>8"). These, combined with an angle guide (see below) will give you a great edge. The disadvantage is the time it takes to manually sharpen a knife. I think it makes little difference whether you use a straight forward stroke, straight pulling stroke or circular motion against the abrasive. The surface area of the abrasive in relationship to the blade will influence this more than whether one motion is better than the other. **Angle consistency (achieved when using an angle guide) is much more important.**

There are a number of round rod sharpeners available. The Ultimate Edge is the best and Gerber's Pocket Sharpener is the worst I have found. Three problems exist with round rod sharpeners: 1), the grit is typically too course; 2) the angle used tends to be inconsistent between and within strokes; and 3) obtuse stroke angles. Coarse grit and obtuse, inconsistent stroke angles will wreck your blade. I love ceramic rods (Alumina in a ceramic bonding agent kilned to 3,000 degrees F (1632.4 C) for 72 hours) for fine-tuning a good edge. These really are not sharpeners; they are more like steels. Most are very fine-textured. Even though veterinarians don't have the time to devote to properly using a manual abrasive for sharpening their necropsy knives, they should always have a ceramic rod close by for keeping an edge tuned up.

There are a few excellent manual knife sharpening systems (system equals abrasive plus angle guide). These include DMT, LS Lansky, Gatco Edgemate and Blademaster Sharpening Systems. All of these systems have a clamp to hold your knife and a series of abrasive grits. The blade clamp on both units has a series of guide holes on either side of the clamp. The guide holes serve as angle guides (10 to 30 degrees) for a rod attached to the abrasive. Most systems are available with diamond abrasive. The cost will vary from $25 (stone) to $65 (diamond) and are available at most sporting good stores. The DMT system sells for about $40 and comes with a medium and fine abrasive. If you already have an excellent whetstone, you can purchase an angle guide, such as the "Edge Guide", from Razor Edge Systems (218-365-6419) or the "Roledge" from Benchmark (Cabela's#

HF61260-900). A 1/4" spring paper clip attached to the back side of the blade also works. More about using a paper clip later.

Most abrasives don't need lubrication. If you use one, I think water is best. I avoid using oil, since it adds nothing to sharpening and may speed edge deterioration. Oil on a stone will prevent "slick spots" from developing. Slick spots are caused by grit building up on the stone. Modern abrasives don't need oil. Abrasives need to be cleaned after each use. Water is the best cleaner I have found.

Avoid "magic" sharpening devices. Most of these will give the illusion of sharpness by breaking out microscopic pieces in the blade edge. These nicks in the knife blade's cutting edge give the edge a serrated pattern ... the knife seems sharper for a few cutting stokes, but repeated use will wreck a blade.

Maybe an exception: Tungsten "V" metal cutting blades are almost magic, literally cutting an edge onto the knife blade. These are either two tungsten blades mounted in a "V" or tungsten wheels aligned so that a "V" is formed between the two blades. Most of these will put a reasonable edge on a soft to medium-hard (Rockwell < 65)metal blade fast, and they do not require much work or skill. Smith's Jiff Sharp is a good, inexpensive (~$10) model, but the best of these devices is the "Meyer Sharpen-It", Meyerco Mft., Dallas, TX that sells for about $30. It has three tungsten wheels for shaping the edge and three ceramic wheels for honing the edge.

All Manual Systems Are Slow: This is especially true if the reflection (relief) angle is thick (see Sharpening Angles below). Unless sharpening a knife is a hobby, find an abrasive with a motor.

My Favorite Abrasives: I love a mechanical (low RPM, half speed motorized) means of sharpening knives. They save time and most have angle guides. I have been asked about how fast a mechanical system will "use up" a blade, grinding it down to nothing... I don't believe you will use up a blade any faster than a manual system, unless you are over-grinding the blade.

The best inexpensive, motorized sharpener I have found is the $40 electric WEN (Wen Products of Chicago, IL at 1-800-736-4936) "Wet Stone Sharpener" (#2908). The unit is a real wet stone, that turns just over 1,000 RPMs. This unit has a variable angle guide (see below) that will let you work all three angles of a blade's cutting edge. WEN also makes the "Wet Stone Sharpener" (#2900) that sells for $75. The $80 "Chef Choice" (model 110), diamond three wheel sharpener is not too bad (use a soft touch) for kitchen knives. The Reliant Wet/Dry Sharpener (#dd68) from Trend-Line (www.trend-line.com or 800-767-9999) is awesome @ only cost $100. It includes a flap sander and 1000 grit wet stone.

There is a 110 or 112 volt sharpening unit that is almost "magic". It is the $40 WEN Sportsman's Edge (#2910), and will put a sharp cutting edge on a blade quicker than any unit I have tested. It will only put one angle on the edge (the principal cutting angle), and that angle is not very smooth, but your knife will cut. The biggest problem is the loss of the reflection (relief) angle (see Sharpening Angles below). As the blade is worn off the cutting edge gets thicker. A thicker cutting edge is harder to sharpen, plus it requires that more force be applied to the cutting target.

The WEN Wet Stone Sharpener works well with axes, knives and shears. It does take practice, and it takes more time to put an edge on a knife than the WEN Sportsman's Edge. But it works great if you follow the sharpening angles discussed below. One note: The angle guide for this unit is not as steep as I believe it should be (lowest setting is 15 degrees). I tape a 1/8-inch metal strip on the angle guide for the Reflection (Relief) Angle (RA) and a 1/16-inch metal strip on the angle guide for the Transition Angle (TA). I use the lowest setting (15 degrees) for the Cutting Angle (CA) ... (the first 1/16" of the edge).

Another option is "Abrasive (Silicon Carbide) Coated Cardboard Sharpening Wheels" (ACCSW) attached to a small-housing (Black & Decker #9704) bench grinder. They work great on small blades, but are not very durable. You will need to resurface the coarse wheel after sharpening about 10 knives and this can be annoying because you spend as much time resurfacing the wheel as you do sharpening knife blades. Because the ACCSW are attached to a high-RPM bench grinder, the knife blade can overheat and loose temper loss. This is not a real problem unless you work the edge too fast. A bench grinder spins from top forward to the bottom which is awkward for sharpening knives. I remove the wheel covers and work from the back or turn the base 180 degrees, allowing me to work against an upward spin. I know of only one supplier for the ACCSW: Knives-Plus in Amarillo, TX (806-359-6202). The system costs about $25.

As an interlude (sharpening trivia): A pinch of silicon carbide or aluminum oxide also works great as a loose dressing for a rigid (glued to a piece of wood), oiled heavy (9 to 12 oz) leather strop. Strops provide more fine tuning than most people want for their kitchen knives but are great for the sharpening hobbyist.

Don't forget the value of a file. Files don't work on hardened metal, but on the soft metal of an ax, they work great. A new flat bastard or mill file will make most axes work-ready. A cross-cut design will last longer, but does not create as smooth an edge. Keep your files clean and dry. I oil my files after each use with WD40. Quick tip for edges that take a pounding: a short, thick reflection will make the edge more durable.

Building A Knife Sharpener
(See Figure 1)

For the Sharpening Fanatic: Adapt a bench grinder to "flap sander" and "buffing" wheel knife sharpener. A Black and Decker small motor housing bench grinder (model # 9407) can be fitted with a 6x1 inch 80 to 180 grit sanding flap wheel (Superior, Condor, or Kendeco Abrasives). You may need an adapter to fit the flap sanding wheel to a 1/2-inch arbor. A 6x1 inch laminated buffing wheel (2-6"x1/2" Disco spiral sewn hard #40 sandwiched together) or a 6"x1" felt wheel (Yergers Mft) coated with buffing compound (Disco E5 or SCR) or pumice. 3-M Inc makes a number of soft abrasives that work great for sharpening knives. For reference: Superior Abrasives (513-278-9123), Yerges Mft (419-332-9905), or 3M (800-364-3577 or 800-742-9546). Most hardware stores can supply 6x1 abrasive flap sanding wheels and buffing wheels.

Assembly: Remove the grinding wheel protective covers and stone grinding wheels from the bench grinder. Slip spacers (1/2-inch to 1-inch arbor bushing) over the arbors of the bench grinder. Mount the flap sanding and felt wheels. Apply a light coat of oil on the buffing wheel, then apply the dry buffing compound by spinning the wheel and holding the buffing compound against the felt wheel.

NOTE: The normal direction of the wheel spin on a bench grinder is from the top forward to the bottom. I find it hard to see the thinning metal burr develop on the blade with this direction of spin. I leave the wheel covers off the bench grinder and work from the back side of the grinder. When facing the back side of the grinder, the wheels spin from the bottom toward the back and up to the top. I find this upward spin easier to use. Reversing the base of the grinder will also change the direction of the spin. A 3600 RPM bench grinder spins three times faster than is appropriate. The rapid spin will rapidly overheat a blade and cause temper loss. Work in very short time intervals.

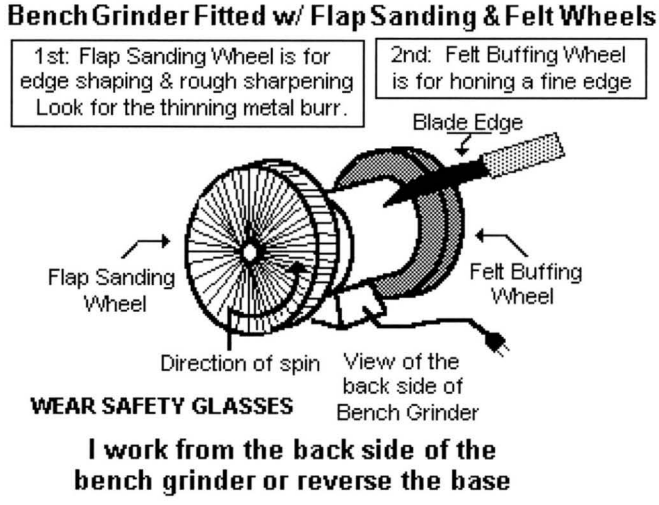

Figure 1.

Tip for controlling the speed of a 3600 RPM bench grinder motor: get a standard electronic speed controller from your local hardware store, which can be mounted in a plastic wall receptacle box (from the same hardware store!). This type controller is used for ceiling fans, and down here in the desert, home evaporative coolers, a.k.a. "swamp coolers". This is an infinitely variable speed model, not a "5 speed" type.

With this controller, you can literally "dial in" whatever rotational speed/RPM level you want. This is not a resistance controlled piece, but an electronically controlled one, so it tends to maintain motor torque at reduced rpm. Yes, the torque is reduced somewhat, but at the very light pressures you use for blade polishing, there should be absolutely no problem. If your local hardware store does not have them, check with an electrical supply store.

NOTE: WHEN USING A WHEEL GRINDER or FLAP SANDER, ALWAYS HOLD THE EDGE OF KNIFE AWAY FROM THE DIRECTION OF THE SPIN and WEAR SAFETY GLASSES.

Key Point: Blade / Edge Shapes
(See Figure 2)

Basic blade shapes: most boning knives have flat ground blades. Some flat ground blades are advertised as "high relief", meaning the blade has been ground thinner from the cutting edge to the top of the blade. A few have hollow ground/concave blades.

Hollow/concave blades are easy to sharpen, but the cutting edge is fragile. Double angle/modified "V" provide very durable blade support and are great for tough cutting. This is typically the kind of edge produced by motorized sharpeners. Convex edges seem as durable as a double angle, and if not abused seem to hold a fine cutting edge longer than a double angle. A flap sander sharpener produces a convex cutting edge. The single sharp edge is the best edge for hard coated blades (titanium

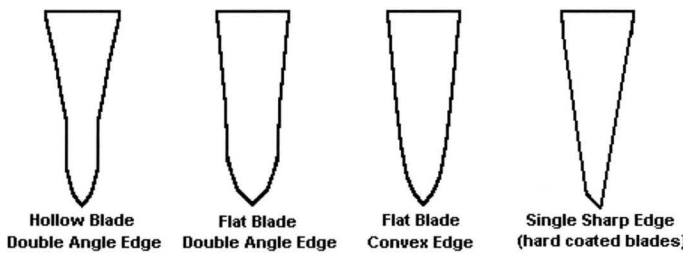

Figure 2.

carbonitride). Hard coating blades will increase the hardness by 30 to 50 (50-100 claimed) percent. To take advantage of the coating hardness only one edge should be sharpened and the coating must extend to the cutting edge. Serrated edges are typically only sharpened on one edge (more later).

Angles of a Sharp Cutting Edge (See Figures 3 and 4)

The "double angle" cutting edge: this is the cutting edge produced by systems which use edge guides. There are three important angles. The Reflection (Relief) Angle (RA), begins at the junction between the blade and the first part of the sharpened portion and generally is considered the thickness of the first 1/4" to 1/2" of the blade. The RA thickness at the blade junction is about 10 t0 20% the length of the remaining sharpened surface (SS). This is the RA:SS ratio, (1:5 to 1:10). The Transition Angle (TA) (the transition between the reflection and the cutting edge, about 1/16" from cutting edge) and the Cutting Angle (CA) (the cutting edge). Hollow Ground blades have the RA curved inward.

Work the following angles in order: 1) the Reflection (Relief) Angle (RA) is about 10 to 15 degrees from the perpendicular (if the RA is correct the next two angles are much easier to work), 2) the Transition Angle (TA) is

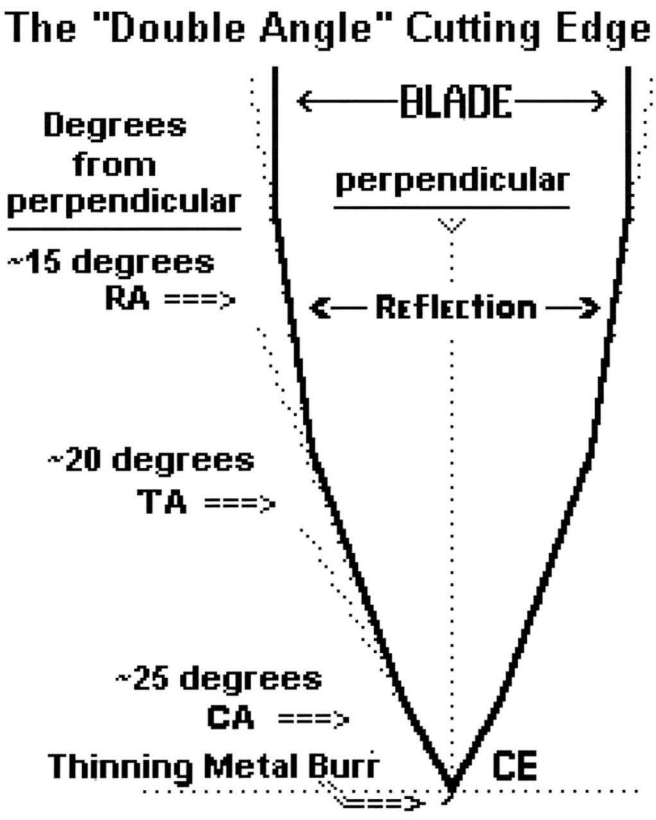

Figure 3.

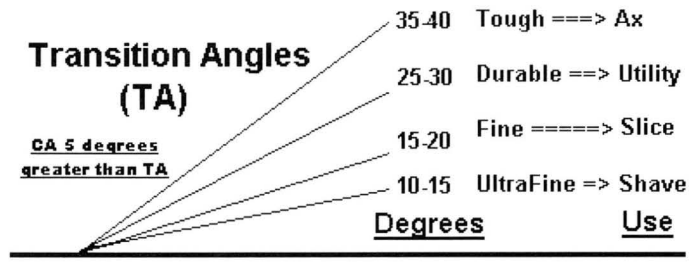

Figure 4.

about 15 to 20 degrees from the perpendicular, and 3) the Cutting Angle (CA) is about 20 to 25 degrees (CA usually 5 degrees greater than TA) from the perpendicular. These angle values are only guidelines. Which edge shape do you need? A very fine, smooth as silk, cutting edge can be produced if you decrease the angles by an additional 5 to 10 degrees, (hollow ground blades often have very acute angles) but durability is lost. Convex edges blend the junction between all three angles in a smooth curved surface. Lots of my work requires the blade to be exposed to tough cutting. The "double angle" edge described above is the most durable of the three blade shapes. When an edge is damaged (bent) it can often be fixed, but only with a light touch on a smooth steel. Severely damaged edges require reworking on an abrasive.

There is not a perfect angle for a cutting edge ... only knives with a cutting edge angle not suitable for the job you want to do.

Remember, always work the TA to the angle you want and set the CA about 5 degrees greater (improves durability) than TA. The steeper the angles, the easier it is for the edge to be damaged. Ultra fine cutting may require a thinner (steep) TA (10 to 15 degrees). Hollow ground blades seem fragile, but they are easy to sharpen. A general purpose TA for meat would be 15 to 20 degrees. Tough use knives need a TA of 25 to 30 degrees. I like my ax set with a thick TA (35 to 40 degrees). The TA on my ax is very short (the opposite of hollow ground). I think (not sure, just think) this improves the durability of the cutting edge ... It needs to be tough, since I cut a lot of bone with my ax. These thicker angles do not affect the sharpness. My ax will shave. In fact, I love my 40 oz, 17 inch "boys" ax. I replace the wooden handle with a fiberglass handle. The Eswing Camper's ax is great, a little light but will last forever.

Keeping the Angles Constant (See Figures 5 , 6 and 7)

It is very important that each of the sharpening angles (RA, TA and CA) be kept constant while working on the edge associated with the angle (RA, TA, or CA). To accomplish this, an angle guide is a great aid. Most mechanical sharpeners have angle guides built into their

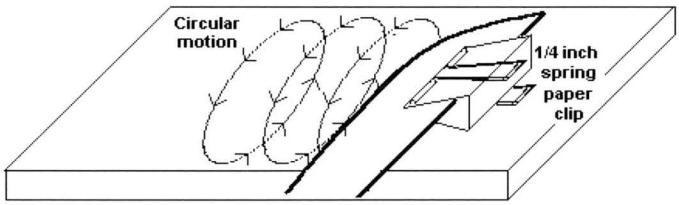

Figure 5.

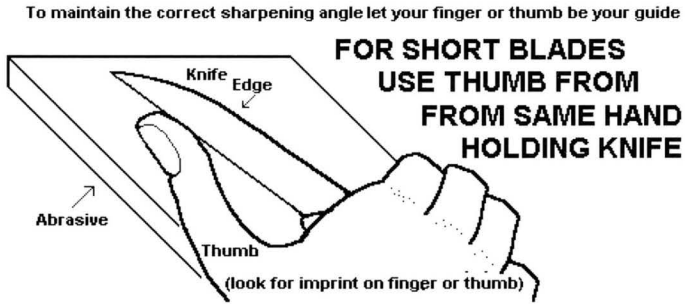

Figure 6.

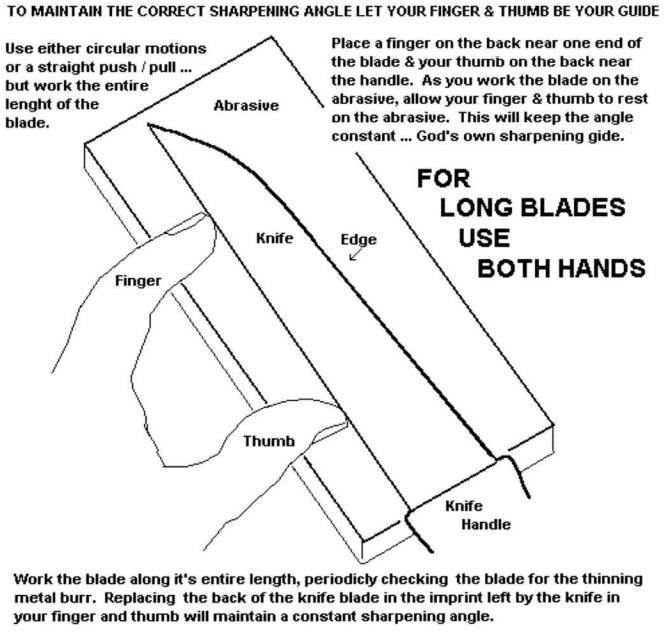

Figure 7.

design. USE THEM. It is very difficult to achieve the proper angles on blades longer than 4 inches without using an angle guide.

For blades shorter than 4 inches, your finger and thumb can serve as angle guides. Depending on the side of the blade you are working, place the finger or thumb on the back of the blade and KEEP IT THERE. Let the finger or thumb rest on the abrasive. This will form the "Angle Guide". Just replace the knife in the imprint formed on the finger print side of your finger or thumb. It works better if you count strokes or motions and use the same stroke count on each side of the blade. You will have to adjust the direction of your motion to work the entire length of the blade. I usually will work each side 100 strokes before turning the blade over. I assure you if you keep your finger or thumb in a knife blade back for 100 strokes you will be able to see and feel where the blade back was located.

Key Point: Determining When the Edge is Sharp (See Figure 8)

Thinning Metal Burr: Look for the "thinning metal burr" ("Feather" or Wire") on the sharpening edge: when the edge metal becomes very thin as it is being ground on an abrasive, it will turn up away from the abrasive. This "turned up" edge is called a "thinning metal burr" (TMB). The burr is the final key to knowing you have approached a sharp edge. It is easier to feel the TMB than to see it. The safest way to feel for the TMB is to use a "steel". I use the palm side of my fingers or thumb nail to feel for the TMB. I pull down across the blade (across the edge, not down the edge ... if you pull down the edge you can cut yourself). The edge will feel rough. If you use a flap sanding wheel (>100 grit) you can see, if you look closely, the TMB turns up as the knife is passed by the spinning abrasive wheel.

Finishing and Testing the Edge

The Final Step: Remove the thinning metal burr: Using a very light touch, stroke the burr on a very fine (greater than 600 grit) abrasive. For this step, I personally like to use a light touch on a ceramic hone or backstroke a smooth soft brass (brazing) rod. On a flap sander motorized sharpener, a hard sewn cloth buffing (2 sandwiched 6"x1" Dico #40) or a 6"x1" felt wheel impregnated with pumice or buffing compound (Dico's E5 or SCR) works great to remove the thinning metal burr. Polishing the edge with a pumice-coated felt wheel attached to a bench grinder will give you a great edge, and a polished blade always cuts better. Many of our disinfectants will stick to the blade, and these deposits will cause addi-

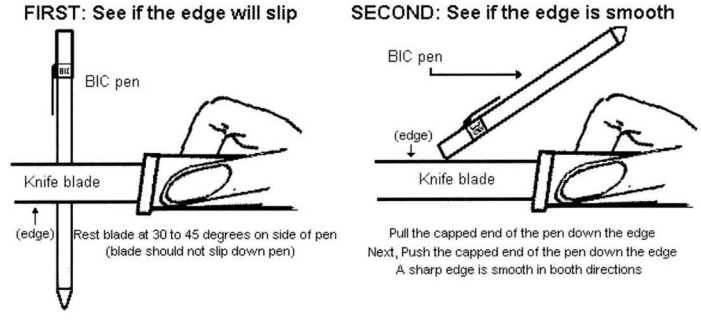

Figure 8.

tional cutting resistance. A perfect edge will not reflect light ("candle").

A "STROPPING" Fine Finish: Strops provide more fine-tuning than most people want for their knives. But if you are interested in a little strop trivia, read on. As mentioned earlier, a pinch of silicon carbide, aluminum oxide or a dry buffing compound works great as a loose dressing for strops. If you have trouble finding silicon carbide or aluminum oxide, ask for "rubbing compounds". It is a good chance your hardware store has what you are looking for but doesn't recognize the chemical ingredient.

They are not as easy to use as it would seem. I have stropped many knives with thick TAs that were duller when I finished than when I started. It takes a practiced touch. When using a strop never let the blade "bite" into the leather. Biting occurs when the back of the blade is lifted too high and the cutting edge of the blade scrapes along the strop. Keep the blade almost flat against the strop. As the edge passes, the soft surface of the strop will curl up against the edge, producing a convex edge. If you allow the edge to bite the strop, the strop surface will actually curl up over the edge and cause dulling of the cutting edge. It is easier to use a strop if it is attached to a rigid surface. I glue thick leather (10 to 12 oz), slick side up, to a piece of wood. A thick woven cotton strap also works well, but holds more abrasive compound and does not produce the fine edge produced by heavy leather. Strop leather should be oiled before using the first time; thereafter, no more oil is needed. Strops should be at least two inches wide and twice the length of the knife blade you need to work. I mentioned cleaning abrasives with water but DO NOT CLEAN A STROP WITH WATER.

Testing the Edge: Shaving your arm is impressive. The preferred way is to rest the blade's cutting edge (at a 45 degree angle) on something smooth, like your finger nail or BIC pen. If the knife does not slip down the smooth surface, it is sharp. Sharp blades should be smooth. Smoothness can be tested by lightly sliding your finger nail or a BIC pen across and down the blade. A perfect edge will not reflect light (candle). Look for reflections from the edge.

Key Point: "The Steel" (See Figure 9)

Using a "Steel": As many blade edges are damaged by steels as are improved. USE A SMOOTH OR FINE-CUT STEEL, WITH A CAREFULLY DIRECTED LIGHT TOUCH.

A steel has aligning grooves designed to straighten an edge. I think it is better to lightly pull the defects back into proper alignment than to push them into alignment. This is accomplished by using a pulling stroke

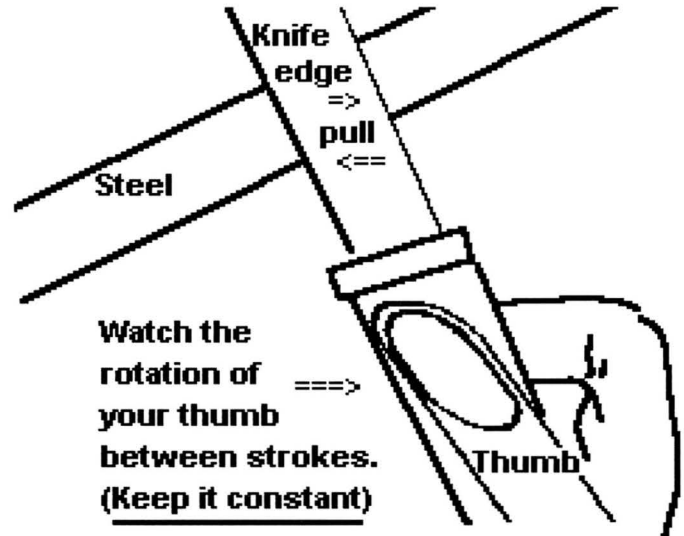

Figure 9.

(pulling up from the handle, away from the cutting edge). After the edge has been realigned, a light down stroke (pushing the edge into the steel) will firm the cutting edge. Be gentle as a hard whipping stroke can wreck an edge as fast as anything I know.

Steels come in four cutting types: coarse cut, regular cut, fine cut and polished - no cut. Coarse and regular cut steels seem to be everyone's favorite ... everyone except those who make a living with a knife. Packing house workers use a very smooth (polished - no cut) steel for most of their knife blades' cutting edge maintenance. You will notice them polishing their steel frequently with an emery cloth (180 to 400 grit). The emery cloth helps keep the steel smooth and the small grooves in the steel aligned. A coarse steel has very distinct aligning grooves. When a blade's cutting edge is used harshly against the deep grooves in a coarse steel, it can cause the cutting edge to chip. The little nicks left in the edge will make the blade seem sharper for a few cutting strokes. The nicks soon wear down, and repeated attempts to "steel the knife sharp will be futile.

The Ceramic Rod as a Steel: I love ceramic rods to touch up cutting edges. I use them like a steel using a soft light touch. Note: ceramic rods are very fine (>1200 grit) abrasives and, therefore do more than straighten edges.

The Grip: Hold the steel as if it were an extension of your arm (stiff but don't over-grip). If held too tightly, the reflex action of the opposite stroking hand is often too firm against the steel, causing blade damage.

The Stroke: When stroking a steel, avoid twisting your wrist or elbow ... keep them stiff. Learn to use the motion of your upper arm and shoulder, rotating your knife hand as you stroke each side of the blade. keep your eye on your thumb! Watching the thumb nail of the stroking hand will allow you to develop a consistent angle on each side of the blade as you rotate your wrist. The angle of the steeling stroke is just slightly greater than the CA you set on the knife (approximately 30 degrees for a 25 degree CA).

Learn to "feel" for defects in the blade's cutting edge. You can feel the small bent or damaged areas in a blade edge. A "pulling stroke" or "back stroke" against the steel is the gentlest approach to a steel. Use the steel to straighten the small bent areas in the blade, not break them. A "coarse" steel will straighten severely bent areas on an edge. If you abuse these areas with the coarse steel, the blade will require reworking.

Care of a Steel: Most "steels" have no chromium and therefore will rust. I clean, dry and oil my steels after use. NaOCl (bleach) will pit low or no chromium metals, such as steels and some knives.

Key Point: Have Enough Good Tools

Buy Lots of Knives: If you make part of your living with a knife, get plenty. The sources of knives I use are KOCH (800-456-5624; http://www.kochsupplies.com/koch-index.html) and Hantover (800-776-6048 http://www.hantover.com/fs.htm), I buy knives by the "six-pack". A great knife costs less than $12 per unit when purchased in six unit orders. The knives I use cost from $7 to $10 each. I like a "stiff" (thick-backed) sheep skinner or boning knife for most of my work. I only buy knives with stainless steel blades and synthetic handles. I never leave home without at least three sharp knives in my case. I would pick knives based on the metal in their blades. INOX is a great European stainless (INOX=stainless), 440C is another good metal. I have used lots of brands of knives and my favorite are (in order): Eicker, Forschner, or F-Dick "INOX" stainless steel knives. Swibo, Kai-cut and Chicago Cutlery (in order) knives are not bad. Henckels are said to be good, if you can afford them. I would not buy most of the other brands I have tried again. My all-time favorite knife is the Russell Green River Sheep Skinner; it is easy to sharpen and holds a great edge. The knife has two problems: its wonderful high (greater than 1.2%) carbon blade is not stainless steel (no chromium) and it has a wooden handle. The blade will rust, so keep it dry (a light coating of oil will also help). The wooden handle can be a problem working around pathogens (salmonella from cutting up chickens). The F. Dick knife # 1348-15 (http://www.fdick.com/ or 800-554-3425 is the BEST necropsy knife ever used but they are very hard to find.

There are several good and not-so-good, over-the-counter knife brands. Case, Buck, and Kershaw are the best I have used in this class of knife. I have never gotten along well with Schrade or Gerber.

It is all About Metal: Hard metal, Rockwell C scale (RC) greater than 58, will generally be harder to sharpen but will hold an edge. Titanium coatings are becoming popular blade hardeners. Hard coatings will increase the hardness 30 to 50% (70RC to 83RC) but are only effective if a single-side edge sharpening technique is used. The hardest blade is zircon oxide, "ceramic". It holds an edge, but the manufacturer asks for the knife to be sent back to them for re-sharpening. The knives are very expensive and the few I have examined have not had fine (hair splitting) cutting edges. Many of the really great knives have 60 to 62 RC blades. Buck uses metal that seems very hard and often is maligned by owners as being difficult to sharpen. They do require more strokes on an abrasive. When troubleshooting sharpening problems with very hard metals, most often the problem is caused by not maintaining a constant edge angle until a thinning metal burr is achieved. Very hard metals require more patience while sharpening but are worth the effort, patience, and attention to details while sharpening (maintaining a constant sharpening angle).

Holding an Edge: If you find you cannot keep an edge on your knife, first check to make sure you have selected the proper blade transition angle for the job you are asking the cutting edge to do. Soft blade metal and/or poor tempering are the other causes of poor cutting edge durability. If the metal is soft (RC <56) it will seem easy to sharpen, it just won't hold an edge. Most axes fall into this category. A few strokes of a flat bastard file or coarse grit (100 to 200) abrasive will have it shaving again. Poor tempering (crystallization) will cause the metal's grain to be coarse. Coarse grained metal will flake or chip easier than fine-grained metal. If the metal has a high RC score (RC>59) as is the case with most stainless steel blades, seems hard to sharpen and will not hold an edge, suspect coarse grain. It is also difficult to get a smooth edge with coarse-grained metal blades. Once sharp, these blades will lose the cutting edge after just a few cutting strokes. Unless it is a keepsake such as your grandfather's tobacco knife, get rid of it ... lose it ... break it ... give it to someone you don't like, but don't fight it ... it will make you crazy. I have repeatedly tried to win the sharpening war with several of these and have never won.

Key Point: Safety

FINAL NOTE: Safety First !!! There is an old saying about a "dull" knife being more dangerous than a

"sharp" knife. I am not sure that is true, but a dull knife often does require more force to be applied to the cutting surface. Slips under pressure are hard to control, therefore could be more dangerous. It is important to control the direction of the cut, and to use a slicing motion (not a straight push or pull against the blade). I love safety gloves such as "Knifehandler II" and "KutGuard". Don't forget the safety glasses if you are using a mechanical sharpener.

Summary and Most Important Tips

. . . **Delegate:** Have someone else sharpen your work knives. Get a good motorized sharpener and if you're a busy veterinarian, ask someone in your clinic to learn how to use the machine.

*** * * * What You Need * * * ***

. . . **Buy a motorized sharpener:** A flap sander (Hantover Knife Sharpener (H=#47090)) with a felt buffing wheel coated with pumice or buffing compound produces an excellent durable convex (rounded) edge. The entire system will cost about $250 ... about the same as the last edition of Jubb and Kennedy. Think of it, sharp knives may inspire you to look at what you have been reading about. A Belt Cutlery Sharpener (sells for approximately $400), or the Tru-Hone Triple Wheel Sharpener (approximately $600) will also do a great job of sharpening your knives. Hantover (1-800-821-2227), Koch (1-800-456-5624), or Packer (1-800-279-7326). The WEN Sportsman's Edge (#2910) or the WEN Wet Stone Sharpener (#2908) are the best inexpensive motorized alternatives to a good professional system. WEN Products (1-800-736-4936) distributes their sharpeners through hardware and sporting goods stores. These two units sell for less than $50. Both of these units will work on a 12 volt to AC inverter plugged into a cigarette lighter socket. Buy at least a 300 watt unit with dual plugs. You can run your computer and sharpener. ABOVE ALL ELSE...AVOID THE GIMMICKS and MAGIC SHARPENER!!!

. . . **If you love to sharpen by hand:** buy the largest flat abrasive you can afford. A 2 inch by 10 inch EZE or DMT fine (600 grit) or very fine (1200) grit diamond hone. They are very expensive (over $75) but worth every penny. I get along with smaller flat abrasives, but I rest my thumb on the edge of the abrasive and move the abrasive across the edge of the blade.

. . . **Keep a constant angle:** THE MOST IMPORTANT THING TO REMEMBER IS TO KEEP A CONSTANT ANGLE BETWEEN THE BLADE AND THE ABRASIVE. You can use your thumb (short blades), thumb and finger (long blades) or a 1/4" spring paper clip for an edge guide.

. . . **Buy a single bit "boys" ax, put a fiber glass handle in it, learn how to use it:** using an ax for making most of your initial skin cuts will save that great sharp cutting edge for actually cutting tissue, instead of mud ball and rocks. Axes are the preferred tool for examination of the CNS (use the lateral canthus as a guide). Keep a new flat file (oil it after each use) or coarse (100 to 200 grit) stone handy for touching up the edge of your ax.

. . . **Buy good knives (at least one box of 6):** Eicker, F-Dick, or Forschner, flat bladed, stiff backed six inch boning or sheep skinning knives work great for feedlot necropsies. These are also available from Hantover, Koch or Packer. A box of six good knives sells for approximately $60 ($10 each). I have two Rubbermaid boxes, one for "Dull/Used" knives and one for "Sharp" knives. As I run low on sharp knives I have a knife sharpening party as I transfer all the knives from the "Dull" knife box past the motorized sharpener to the "Sharp" knife box. I keep a little diluted Roccal (a phenol derivative disinfectant works better when there is organic matter contamination) in the dull box. This works really great if there is someone in your clinic to take charge of the party.

. . . **Buy a smooth (polished-no cut) or fine cut steel, learn how to use it and please be gentle:** more cutting edges are wrecked by the harsh use of a steel than are improved. If you read nothing else from above, please read the part about using a steel. Smooth or fine cut steels are available from Hantover, Koch or Packer. They will cost approximately $15. Forschner makes a combination steel that includes both a polished and fine cut side. Avoid a "regular" or "coarse" cut steel, and avoid diamond steels/sharpeners unless they have an extremely fine grit .

. . . **Buy a ceramic stick (round) hone:** good for finishing or touching up a cutting edge. Available from Hantover, Koch or Packer. A ceramic stick will cost approximately $15. Once again, avoid diamond steels/sharpeners unless they have an extremely fine grit. The EZE and Gerber sticks I have seen are much too coarse.

. . . **Buy safety "cut resistant" gloves:** Available from Hantover, Koch or Packer. A cut resistant glove will cost approximately $12.

. . . **A parting note:** If you have a knife you can't keep sharp, promote it to a tail knife, box knife, or give it to someone you don't like. Don't fight it ... get rid of it.